

Meteorite Falls and the Fragmentation of Meteorites

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In order to understand the fragmentation of objects entering the atmosphere and why some produce more fragments than others, I have searched the Meteoritical Society database for meteorites >20 kg that fell in the USA, China, and India. I also studied the video and film records of 21 fireballs that produced meteorites. A spreadsheet was prepared that noted smell, fireball, explosion, whistling, rumbling, the number of fragments, light, and impact sounds. Falls with large numbers of fragments were examined to look for common traits. These were:

The Norton County aubrite,	explosion and a flare	>100 fragments
The Forest City H5 chondrite	explosion, a flare, a dust trail	505 specimens.
The Richardton H5 chondrite	explosion and light	71 specimens.
The Juancheng H5 chondrite	explosion, a rumbling, a flare, a dust trail	1000 specimens.
The Tagish Lake C2 chondrite	explosion, flare, dust trail	500 specimens.

I conclude that fragmentation is governed by the following: (1) Bigger meteors undergo more stress which results in more specimens; (2) Harder meteorites also require more force to break them up which will cause greater fragmentation; (3) Force and pressure are directly proportional during falls. General observations made were; (1) Meteorites produce fireballs sooner due to high friction; (2) Meteors tend to explode as well because of high stress; (3) Softer meteorites tend to cause dust trails; (4) Some falls produce light as they fall at high velocity.

I am grateful to NASA Ames for this opportunity and Derek Sears, Katie Bryson, and Dan Ostrowski for discussions.

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Method

- The Meteoritical Society database was searched for observed meteorite falls in the US, China, and India where >20 kg were recovered. (Total = 42)
- Fall descriptions were analyzed and cataloged in a spreadsheet for the following terms:
 - Smell, fireball, explosion, whistling, rumbling, number of fragments, light, impact sounds,
- Twenty-one fireballs for which video/film records exist were analyzed.
- Falls with large numbers of fragments were examined to look for common traits.

Results

Norton County (Aubrite) – Explosion, Flare (100+ Spec.)

Forest City (H5) – Explosion, Flare, Dust Trail (505 Spec.)

Richardton (H5) – Explosion, Light (71 Spec.)

Juancheng (H5) – Explosion, Rumbling, Flare, Dust Trail (1000 Spec.)

Tagish Lake (C2) - Explosion, Flare, Dust Trail (500 Spec.)

Goals

Fragmentation: To understand why some meteors create more fragments than others.

Meteorite Falls: To find a clear understanding as to what happens when a meteorite falls through the sky.

Analysis and Conclusions

Fragmentation:

- Bigger meteors undergo more stress which results in more specimens
- Harder meteorites also require more force to break them up which will cause greater fragmentation
- Force and pressure are directly proportional during falls

What Happens As a Meteorite Falls Across The Sky?:

- Meteorites produce fireballs sooner due to high friction
- Meteors tend to explode as well because of high stress
- Softer meteorites tend to cause dust trails
- Some falls produce light as they fall at high velocity

References

The Meteorical Society (lpi.usra.edu)

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